

PATENT
Customer No. 22,852
Attorney Docket No. 04329.2553

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
Masaaki HATANO, et al.) Group Art Unit: 2827
Serial No.: 09/816,177) Examiner: Mitchell, James M.
Filed: March 26, 2001)
For: SEMICONDUCTOR DEVICE)

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

REQUEST FOR RECONSIDERATION

In reply to the Office Action dated January 6, 2003, with a period for response extending through April 7, 2003 (April 6 being a Sunday), Applicants respectfully request the Examiner's reconsideration in view of the following remarks:

REMARKS

In the Office Action, the Examiner rejected claims 1 and 15 under 35 U.S.C. § 102(e) as anticipated by Stamper et al., U.S. Patent Application Publication No. 2002/0053746, ("Stamper"); rejected claims 13 and 16-22 under 35 U.S.C. § 103(a) as unpatentable over Stamper; and rejected claims 1, 2, 13, and 15-22¹ under 35 U.S.C. § 103(a) as unpatentable over Chittipeddi, U.S. Patent Application Publication No. 2001/0036716, ("Chittipeddi"). Applicants respectfully traverse these rejections.

¹ The Examiner actually rejected "claims 1, 2 and 13 and 14 - 22." Since claim 14 was previously cancelled, Applicants assume the inclusion of claim 14 was a typographical error and that the Examiner intended to reject "claims 1, 2, 13, and 15 - 22," which is consistent with the text of the Office Action.

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I. Response to Rejection under 35 U.S.C. § 102(e)

Applicants respectfully submit that Stamper fails to anticipate claims 1 and 15 under 35 U.S.C. § 102(e) because Stamper does not qualify as prior art under 35 U.S.C. § 102(e).

To overcome a rejection under 35 U.S.C. § 102(e), Applicants may perfect a claim to priority under 35 U.S.C. § 119(a)-(d) where the filing date of the foreign priority document antedates the filing of an applied reference. *See* M.P.E.P. § 706.02(b) (8th Ed., Aug. 2001), p. 700-24. Applicants may perfect a claim for priority by filing an English language translation of their foreign priority document, along with a statement that the translation of the certified copy is accurate. *Id.* Furthermore, the Examiner must establish that the priority document satisfies the enablement and description requirements of 35 U.S.C. § 112, first paragraph. *Id.*

In the instant case, Applicants' claimed a foreign priority date of March 27, 2000 based on JP 2000-086383, which antedates the earliest U.S. filing date of Stamper's parent application, May 4, 2000. Moreover, Applicants are currently preparing an English language translation of JP 2000-086383 to file, along with a statement that the translation is accurate. Once the translation is prepared, Applicants will file a supplemental response to submit this English translation along with the statement. Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 1 and 15 under 35 U.S.C. § 102(e) over Stamper upon receipt of the English translation.

II. Response to Rejections under 35 U.S.C. § 103(a)

The Examiner rejected claims 13 and 16-22 under 35 U.S.C. § 103(a) over Stamper. As mentioned above, Applicants are proceeding with removing Stamper as prior art by perfecting the claim of priority. Accordingly, Applicants request that the Examiner withdraw the rejection of claims 13 and 16-22 over Stamper upon receipt of the English translation of Applicants' priority documents.

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Additionally, the Examiner rejected claims 1, 2, 13, and 15-22 under 35 U.S.C. § 103(a) as unpatentable over Chittipeddi. In response, Applicants respectfully submit that a *prima facie* case of obviousness has not been established for claims 1, 2, 13, and 15-22.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Furthermore, "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art." See M.P.E.P. § 2143.01, quoting *In re Wilson*, 424 F.2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Finally, there must be a reasonable expectation of success. See M.P.E.P. § 2143, pp. 2100-122 to 127. In this case, Chittipeddi fails to teach or suggest all the claim elements.

Claim 1 is directed to semiconductor device comprising a combination of elements including, *inter alia*, "an intermediate layer formed at least on [a] Cu film, the intermediate layer comprising a TaN film formed on the Cu film and a Ta film formed on the TaN film, wherein a thickness of the TaN film is 20 nm or more."

Chittipeddi is directed to a semiconductor device having gold wires bonded to copper. Chittipeddi discloses that the semiconductor device comprises a copper plug 44 with a barrier layer 41(patterned layer 55) formed on copper plug 44. Chittipeddi, ¶ 15. The Examiner alleged that the thickness of TaN film recited in claim 1 falls within the range of the barrier layer defined in Chittipeddi. (Office Action, ¶ 11). However, Chittipeddi recites that "[t]he preferred material for barrier layer 41 is Ta, TaN, Ti, or TiN ... [and] a 100 to 1000 Angstrom layer is suitable". Chittipeddi, ¶ 11. In other words, the range defined by Chittipeddi is 10 nm to 100 nm. Thus, Chittipeddi fails to teach or suggest at least that "a thickness of the TaN film is 20 nm or more"

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as recited in claim 1 (emphasis added). Therefore, a *prima facie* of obviousness has not been established.

The Examiner also alleged that "the thickness of the film would have been obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization." (Office Action, ¶ 12 referencing ¶ 8, and ¶ 13). Further, the Examiner alleged that the thickness is *prima facie* obvious because Applicants have "not disclosed for the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical." (Office Action, ¶ 12 referencing ¶ 8, and ¶ 13). In response, Applicants respectfully submit that the thickness of the film is for a particular unobvious purpose, produces an unexpected result, and is critical.

More particularly, in the semiconductor device recited in claim 1, by setting the thickness of the TaN film to 20 nm or more, an increase in the sheet resistance is suppressed after being subjected to the heating process. (See specification, page 15 and FIG. 4.). The conditions for the heating process, indicated by a triangle mark in FIG. 4, correspond to the conditions for a general heating process after the formation of a Cu film, a TaN film, and a Ta film. As seen from FIG. 4, when the thickness of the TaN film is less than 20 nm, the sheet resistance increases abruptly. On the other hand, when the thickness of the TaN film is 20 nm or more, the sheet resistance does not vary substantially. Thus, 20 nm is the critical value, and if the thickness of the TaN film is set to 20 nm or more, the unexpected result of being able to suppress the increase in the sheet resistance is obtained. However, this unexpected result would not be obvious from Chittipeddi because Chittipeddi teaches forming the barrier layer having a thickness less than 20 nm, namely 10 nm. Thus, contrary to the Examiner's allegations, the novel TaN film thickness is not *prima facie* obvious.

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Accordingly, a *prima facie* case of obviousness has not been established for claim 1. For at least this reason, claim 1 is allowable. Claims 2, 13, and 15 are also allowable at least due to their dependence from allowable claim 1. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03, p. 2100-126 citing *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988).

Claim 16 is directed to a semiconductor device comprising a combination of elements including, *inter alia*, "an intermediate layer formed at least on [a] Cu film, the intermediate layer comprising a TaN film formed on the Cu film and a Ta film formed on the TaN film; an Al film formed on the Ta film and used as a pad, the Al film having an extending portion under which the Cu film is not formed; and a conductive connection member connected to the Al film at the extending portion" (emphasis added).

As mentioned above, Chittipeddi is directed to a semiconductor device with gold wires bonded to copper. Chittipeddi discloses that the semiconductor device comprises a copper plug 44 with a barrier layer 41 (patterned layer 55) formed on the copper plug. Additionally, Chittipeddi discloses that an Al layer 52 (patterned layer 56) is formed over patterned barrier layer 55. Chittipeddi discloses that patterned Al layer 56 partially extends beyond copper plug 44. See Chittipeddi, Fig. 20. However, Chittipeddi discloses that a bonding wire 61 is connected to patterned Al layer 56 directly over copper plug 44 but is not connected to the extending portion of Al layer 56. Therefore, Chittipeddi fails to teach or suggest at least "a conductive connection member connected to the Al film at the extending portion" as recited in claim 16 (emphasis added).

Accordingly, a *prima facie* case of obviousness has not been established for claim 16. For at least this reason, claim 16 is allowable. Claims 17-22 are also allowable at least due to their dependence from allowable claim 16. See M.P.E.P. § 2143.03, p. 2100-126.

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III. Conclusion

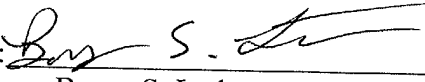
In view of the foregoing, Applicants respectfully request the reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: April 7, 2003

By: 
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